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Assessment of the Efficacy of *Tephrosia vogelii* Hook Leave Decoction to Control Major Pigeonpea Pests in Eastern Kenya

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Keywords: Pigeonpea - *Cajanus cajan* - Pest control - Tephrosia

Summary

An on-farm trial was carried out in Karaba county (900 m a.s.l.), Mbeere district, Kenya, with 14 farmers during the 1999-2000 short rainy season in order to assess the efficacy of tephrosia leave decoction to control the main pigeonpea field insect pests. In each farm, two plots were planted with the short-duration pigeonpea cultivar ICPL 87091, either in sole crop or in intercrop with maize. Seven farmers treated half of their pigeonpea plots three times successively at 15 days intervals with 400 g.ha^{-1} dimethoate, 885 g.ha^{-1} diazinon and 19.2 g.ha^{-1} lambda-cyhalothrin and sprayed the rest of their plots four times at a 10 days interval with a Tephrosia vogelii *fresh leave decoction (at a rate of 200 kg of leaves in 200 litres.ha^{-1}). In the other farms, half of the plots were sprayed with the same insecticide pest control programme as in the first ones while the rest of the plots was left unprotected. Almost no yield (14 kg.ha^{-1}) was obtained in the unprotected plots while the average yield produced in the tephrosia treated plots (671 kg.ha^{-1} was only slightly lower than the mean production obtained in the insecticide protected plots (875 kg.ha^{-1}).*

Résumé

Évaluation de l'efficacité d'une décoction de feuilles de *Tephrosia vogelii* Hook comme moyen de contôle des ravageurs du pois cajan dans l'Est du Kenya

Un essai en milieu paysan a été réalisé dans le comté de Karaba, District de Mbeere, Kenya, lors de la petite saison des pluies 1999-2000 avec 14 agriculteurs, afin d'évaluer l'efficacité d'une décoction à base de feuilles de tephrosia pour contrôler en champs les insectes ravageurs du pois cajan. Chaque agriculteur a semé deux parcelles de la variété précoce à croissance déterminée ICPL 87091, une en culture pure, l'autre en culture associée avec du maïs. Sept agriculteurs ont traité la moitié de leurs parcelles de pois cajan en appliquant successivement à 15 jours d'intervalle 200 litres de bouillie contenant 400 g.ha^{-1} de dimethoate, 885 g.ha^{-1} de diazinon et 19.2 g.ha^{-1} lambda-cyhalothrin et le reste de leurs parcelles en appliquant à quatre reprises 200 litres de décoction de feuilles fraîches de Tephrosia vogellii *(à la dose de 1 kg de feuilles broyées par litre). Les autres agriculteurs ont protégé la moitié de leurs parcelles en utilisant le même programme de pulvérisation d'insecticides chimiques que les premiers et ont laissé l'autre moitié de leurs parcelles sans protection. Pratiquement aucune production de graines (14 kg. ha^{-1}) n'a été obtenue dans les parcelles laissées sans protection alors que le rendement moyen obtenu dans les parcelles traitées avec la décoction de feuilles de téphrosia (671 kg.ha^{-1}) n'a été que légèrement inférieur à celui obtenu en appliquant les insecticides chimiques (875 kg.ha^{-1}).*

Introduction

Insect pests are generally the major constraint to pigeonpea production everywhere this crop is planted. In eastern Africa, the main field pests of pigeonpea are pod sucking bugs, pod borers and podfy (7). Aphids and thrips can also cause damage but do not represent a major problem. The most commonly occurring pod borers are lepidopteran larvae *Helicoverpa armigera* Hubner and *Maruca testulalis* Geyer; *Etiella zinckenella* Treits larvae can be found in maturing pods but is a less serious threat to pigeonpea production. The most serious pod sucking bug is the adult hemiptera *Clavigralla tomentosicollis* Stål. The only podfly found in pigeonpea in Eastern Africa is the diptera *Melanagromyza chalcomosa* Spencer (8); its larvae

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Received on 12.10.00 and accepted for publication on 12.10.00.

which feeds on green seeds inside the pods can cause major economic losses. Short-duration varieties of pigeonpea are much more heavily attacked by pests than long-duration cultivars (5). Results of surveys carried out in 1995 and 1997 showed that in eastern and southern Kenya, the percentage of farmers controlling insect pests with chemical insecticides varied very much from one district to another, many farmers being reluctant to use pesticides because of their high costs, the unavailability of sprayers and water (4). Other factors such as high toxicity for the users and very negative side-effects on the environment make reliance on chemicals an unsatisfactory strategy (2). In the recent years, different research institutions have carried out investigations on a promising insect repellent made of crushed leaves of *Tephrosia vogelii*, a shrub originating from central Africa (4). This plant and other related species were used as source of rotenone, an important non residual insecticide, before World War II (1). This paper presents the results obtained in an on-farm trial carried-out in eastern Kenya in order to assess the efficacy and the adoption prospects of tephrosia leaves decoction to control pigeonpea field insect pests.

Material and methods

The study was conducted in Karaba county which is located at 900 m above sea level in Mbeere district. Average rainfall per season is around 300 mm with two rainy seasons a year. The first rains go from October to December and are more reliable. The second rainy season goes from March to June. Three types of soils are found in the area, namely red clay, red sandy and black cotton.

Thirty farmers were selected in three villages i.e. Ndiandasa, Uthithini and Wamikuyu. The group of farmers selected included majority of female farmers who are fully involved in farming activities. Farmers were asked to plant one short duration variety ICPL 87091. Planting took place in November 1999 at the start of the short rainy season.

ICPL 87091 was planted as a sole crop and intercropped with local landraces of maize.

Recommended intra and inter row distances were respectively 30 cm and 60 cm in sole crop and 45 cm and 90 cm in intercrop. Within each system, two separate plots of 15 x 15 m were planted, each plot corresponding to one type of spray either chemical insecticide or biorational.

One month after planting, upon the basis of the quality of the crop and of its management by the farmers, it was agreed to continue the programme with ten farms out of the thirty preselected. To assess the pests incidence in the area during the cropping season, ten other farmers kept half of their plots uncontrolled.

Chemical insecticides were supplied by the project to ensure sprays were adequately realised. Three types of chemicals were given to the farmers to be used successively namely dimethoate (Dimethoate®), diazon (Diazol®) and lambda-cyhalothrin (Karate®). Recommended spraying programme was 3 sprays at 15 days intervals. Most farmers actually carried out four sprays.

Tephrosia solution was made by soaking fresh leaves of tephrosia in water for 24 hours. The rate used was 200 leaves (about 1 kg) per litre of water. The solution obtained was not diluted. The application rate was 200 litres per hectare (i.e. 200 kg of leaves to spray one hectare). A total of 4 sprays were carried out at 10 days intervals.

Both biorational and chemical insecticides were applied from flower bud stage onwards.

Grain yields were determined from each plot at harvest. Pods were not sampled for seed damage due to the low pod production in all farms.

Results and discussion

Among the twenty farmers, two lost their crop following destruction by livestock and four did not obtain any grain because of insufficient soil moisture in their plots (only on red soils).

The detailed yields are shown in table 1, with number 1 to 7 corresponding to the farms with chemical/tephrosia treatments and number 8 to 14 to the farms with chemical/no control treatments. In farms 8 to 14, modest grain yields were obtained in chemical sprayed plots whereas the unsprayed plots did not produce any grain except at one farm. The nearly complete grain yield losses in unsprayed plots indicates that pests incidence was generally high in the area during the cropping season.

Table 1
Pigeonpea grain yield (kg.ha^{-1}) for ICPL 87091 at 14 farmers sprayed with chemical insecticide and biorational, Karaba sub-location, Eastern Kenya, short rains 1999-2000.

	Chemical		Control		Tephrosia		Means
Farmer	Intercrop	Sole	Intercrop	Sole	Intercrop	Sole	
1	0	600			0	200	200
2	300	1800			200	1600	975
3	50	600			50	1000	425
4	100	1000			50	1000	538
5	200	800			200	400	400
6	50	600			50	100	200
7	200	600			200	400	350
Mean	129	857			107	671	441
CV(%)	84	52			83	81	60
8	300	800	50	100			313
9	100	200	0	0			75
10	50	200	0	0			63
11	50	100	0	0			38
12	100	200	0	0			75
13	400	1000	0	0			350
14	200	400	0	0			150
Mean	171	414	7	14			152
CV(%)	79	84	-	-			84

Results from farms 1 to 7 show that though yields in chemical sprayed plots are higher than in tephrosia sprayed plots, there was no significant difference between the two (Table 1). In a high pest incidence context, this result indicates that tephrosia leave decoction was effective.

Yields were significantly lower in intercrop than in sole crop. The poor performance of ICPL 87091 in intercrop

was expected as all short duration varieties are negatively affected when intercropped with a cereal (7). However there was no interaction between the cropping system and the treatments. Pigeonpea cropping patterns do not affect pests incidence as it was reported by Minja (5) in a study on the effect of intercropping on seed damage caused by insect pests.

Conclusion

The application of tephrosia leave decoction on pigeonpea allowed the farmers to get substantial grain yield where most of the crop would have been lost if left unsprayed. Though the trial should be repeated in different agro-ecological zones and over several seasons, the results obtained so far are encouraging. The most expensive input, both financially and environmentally, is insecticide. Tephrosia can be grown by the farmers providing them with a free pest control product. In Karaba, most farmers use insecticides; though they might be reluctant to abandon totally chemical control for a less effective biorational, they could still grow tephrosia and use it as an alternative to insecticides, for example when pest population is not high. In more marginal areas where insecticides are not available to most farmers, the use of tephrosia could have an even better impact on the farm and household economy. Further investigations are needed to assess the profitability of this type of pest control method which application is within the capabilities of most small scale farmers of the region. Considering the very interesting potential of this plant to control field and storage pests and the lack of knowledge regarding its possible side effects on human health, we think that it is urgent to submit it to a complete toxicological study in order to define safe recommendations for its use by small-scale farmers.

Acknowledgement

The research work reported in this paper was funded by European Union in the framework of the project "Genetic improvement of pigeonpea and management of intercropping systems in the semi-arid areas of east Africa" (Contract N°: ERBICIC18CT960130).

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